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Application No. 10/615,443

Confirmation No. 7388

Examiner: Harry B. Tanner
Art Unit 3744

RE: APPLICANT REPLY TO OFFICE COMMUNICATION

12-14-2004

Attn: Harry B. Tanner

Responding to your office action concerning distinctness of inventions (I-VI) in my application, I submit the following. I am traversing the requirement to restrict and am electing the subject matter of Group II for this communication. However, as the burden falls on yourself or the examiner who will be further reviewing this application, please consider the following argument of support.

The various components and functions of the apparatus and method claims are intended to constitute a "packaged air handling system" designed to operate as an "air-handling unit" whether through constant or variable volume design application. This concept will be linked primarily to claim 1, Group I. As such, each claim may be further linked if required to support this idea as I feel has been pointed out in the description.

An added Generic Claim spells out "Packaged Air Handling System" and is linked in accordance with apparatus claims 1, 162, 163, 299, and all method "means" claims. In lieu of the subject matter of this claim, this Generic Claim should be found to be "allowable in substance…action on the species claims shall thereupon be given as if the generic claim were allowed." MPEP 809.02 (e). The linking claims relate to MPEP 809.03, (A) genus claims linking species claims; and (C) a claim to "means" for practicing a process linking proper apparatus and process claims.

Furthermore, I can maintain that the subcombinations (usable together) are essential to the combinations, MPEP 806.05 (c) II. SUBCOMBINATION ESSENTIAL TO COMBINATION, wherein no restriction is required, "even though the subcombination has separate utility." I can also argue that the Basic Subject Matter, i.e., the combination of features are necessary and essential to the fundamental character of the subject matter treated, MPEP 903.02 (b), "Scope of Class." The fundamentals in question are also supported by affinity laws, scientific facts, current research studies, and building codes pertaining to the subject matter in question.

Firstly, the primary mover must operate in conjunction with the variable system to perform correctly and illustrate those facets of its predicted performance on the display panel, namely in its speed control response to changing system characteristics as required to maintain or alter its constants against the system. As the central point of system operation, the operating point is the tie that binds the whole "package," which begins fore and extends aft of the primary mover.

The method of the OP (Operating Point) and its placement is also vital in keeping the primary mover within its usable range and out of its "No Select Zone" at the left of the curve. The same applies to the terminal device, its individual constants, and the Total Pressure Constant for a variable system and its mover, the "metes and bounds" of which systemic operation and the mover powering it must remain drawn to. This also necessitates the dynamic structure housing the mover up and downstream with its containment of these integrated features.

The monitor display and interpolative processing method (Group II) is also a needed minimum basis for control of current building management systems where modern commercial HVAC systems and their operation is concerned. Though viewing information may be more illustrious in various forms, the "minimum requirement" to satisfy the need for this feature is one that performs calculated steps in an interpolative relationship as described in order to accurately design, operate, or monitor any such performance characteristics as can in no other feasible way be correctly determined. This point is elaborated on in the specification in the paragraphs pertaining to "solving unknowns" and the tendency to view data points outside the context of such a necessary relationship. Noted curves and data points are established through interpolation between firmly established knowns as specified there, particularly BHP and Total Pressure. For example, recall the myopic idea of viewing only a Static Pressure data point against a measured flow rate inside of an unknown system with unknown characteristics and the extrapolative practice of misdiagnosing those characteristics. Also note: the deductive evaluation of dynamic, frictional, and leakage losses, along with adverse mover performance. See also "System Effect" incurred upstream and downstream of the primary mover, its packaging in "draw-through" or "blow-through" systems.

In short, the system whole may be viewed as a larger, unitary housing, which contains the mixing box, coil (heat exchanger), blower, and downstream ductwork fitted with flow monitor and valve control stations. This is one integrated system, which does, in fact, necessitate all of its components and functions as needed to operate effectively. However, they were presented as separate fittings largely to make the original specification document more digestible and allow the flexibility of "retrofitting" options to existing systems, not to divest from the prevailing idea of a "packaged system."

Beginning with the mixing box, the description notes that one of the key problems with current smoke control sequencing actions is their inability to deal with a drastically different system curve in their change from "normal mode" to "smoke mode" operation. The method and apparatus claims are required to work together to perform the necessary critical function of placing or replacing the operating point in its necessary field. Such sequencing actions also involve the mixing box, any main damper sequencing, and all downstream damper control sequencing working in conjunction, including variable terminals.

Additionally, the blower's speed and Total Pressure control plays a crucial and necessary role here as well. As previously noted, the Total System forms an inductive, circuitous path from its intake to its discharge. The mixing box, where return and outdoor air are mixed in particular measures, provides appropriate air changes for both normal and smoke mode operation. Thus, the smoke mode Group VI is simply another "mode of operation" for the same invention, a packaged air handling system. The terminal devices are also integrally involved, as they must open to their maximum or designated positions in smoke mode when they are not modulating in normal mode to achieve appropriate makeup air changes per zones served.

As a suction side module of main damper control, the mixing box and its settings in large part determine the operating point of the system whole, also because "System Effect" losses are most pronounced here. Essentially, the module described and claimed in Group V is part of the main package housing containing two variable terminal devices arranged in parallel. In normal mode operation, the mixing box must maintain a minimum requirement of Outdoor Air as deducted from Total Air throughout system VAV modulation. As noted in the specification, the VAV terminals also play a central role in establishing both the Total System Curve and Total Pressure Constant, along with the blower's modulation within these boundaries. VAV's must also maintain necessary Outdoor Air requirements on a per-zone (terminal branch) basis when they modulate to their minimum settings.

The mixing box controller becomes especially critical when the air handling system operates on an economizer or changeover system, wherein OA/RA positioning changes are extreme. Depending on the season, demand on the heat exchanger creates uneven loading on the thermal side as well. Economizers are also known for creating instability in an air handling system, which extends into current static pressure and fan speed control processes, thus producing a repercussive effect on the system whole.

A current article published in HPAC magazine supports the integration of the critical components of an air-handling system in its study of "cascading instability," which affects the system dynamically and thermally. Consequently, the "control loop" governing such a system, prone to much thermal lag of heat exchange devices and hysteresis of control modulation, cannot cope. A key point made in the article addresses the fact that "an amazing number of commissioning problems are rooted in integration failures..." indicating that such problems stem from the fact that [control] "systems in need of integration were of different classes and specified by different engineering groups without a practical, mutually understood communication protocol." The article also emphasizes the "critical interlock between makeup and exhaust system operation..." as would pertain to either clean room or smoke control operations.

As noted in the specification, where there is an integrated exhaust system (or secondary mover) as part of the package, Total Air = OA + RA – EA. The claim regarding an energy recovery unit Group III would suggest an integration of the above packaged system wherein the heat exchange medium and housing would include an integrated exhaust system (in-line secondary blower) or simply a blower placed in counter-flow to the heat exchanger and bypassed to atmosphere.

Where building pressurization and mold mildew problems crop up, it is imperative that buildings have adequate, properly conditioned Outdoor Air quantity to keep a building envelope under positive pressure in excess of any exhaust systems and, thus, prevent infiltration from the exterior of the envelope. Conversely, Return Air becomes crucial in providing adequate recirculation of air to avoid stagnation (or stagnant air) and to avoid excessive loading on the heat exchanger.

These effects are not limited to the air moving or control devices within the air-handling system. They include the heat exchange device, because, other than interior space air, Outdoor Air must be pre-treated or dehumidified to an appropriate %RH (Relative Humidity) and the heat exchanger must effectively meet these requirements as well through calculating step functions noted with a direct reference to air flow changes caused by all variables in the system. Ultimately, these factors directly impact mass flow rate delivered or exchanged. The above actions from mixed intake air throughout the variable distribution system delivery determine the placement of the operating point(s) where necessary by the method means and those components provided by the apparatus.

Regarding Group IV, the increase of BHP by way of modulating blade pitch angle and dampering of an axial mover pertains to a packaged system in which an axial fan is used in place of a centrifugal blower; or both used together in-line. This may be a primary or secondary mover; e.g., axial fans may be used as return side blowers, or as integrated exhaust blowers bypassing flow to atmosphere with or without a recovery vehicle in-line. An electric motor powered air handling system is often subject to BHP losses due to modulation of its system components and this group is intended to address this problem by providing usage of the same components, 1) a primary or secondary axial mover and 2) a variable terminal device with a monitored operating point (main damper control) on

the discharge, effectively diametric and diverging downstream of the mover. This is used to compensate for such BHP losses or to produce needed BHP increases by performing those functions noted as would be unique to the characteristics of such an axial fan, whose y value and BHP increase with throttling in particular measure against the controlled mover constant, where centrifugal movers have the opposite effect on particular regions of the coordinate graph.

Variable speed control means may cause the system to experience losses in its lower operating range, where the electric motor's power factor is not used effectively. Where the x/y values are concerned, this group function applies primarily to the y value and its adjustment along the x-axis.

The described pitch angle modification also presents an alternate means of mover modulation other than typical electric speed control within a variable system. The same mover constant is simply maintained through x/y adjustments as would pertain to the characteristics of an axial fan. Such an axial mover also assists in overcoming "System Effect Losses" as these losses are dynamically oriented and mostly occurring on the intake or suction side of a housed air-handling unit.

In summary, the air handling system encompasses a unitary structure with an inductive opening to atmosphere from which primary air is injected into a building envelope. The total losses and gains attributed to this system are directly impacted by each integral component of the air handling system, here expressed as a total power factor from intake to free delivery of air into a vessel or envelope. Along with volumetric flow rate, the temperature and density changes of the air-fluid entering the system are also key controlling factors as they ultimately determine RH (Relative Humidity), Mass Flow Rate, Heat Exchange Effectiveness, and pressurization of the interior building envelope. Because of the disparity of current systems, their control loop operation is subject to much instability and hysteresis; both thermally and where total dynamics are concerned.

For accurate performance prediction, the system operating point must be viewed in the context of the system whole and its complete parameters as described above and in the specification. Otherwise, the "floating" data points currently used to design, build, and operate these systems are subject to a wide margin of error.

The Total System operating point is a product reflecting the air handling system performance up to the boundaries of the building envelope, the vessel being delivered to. This includes the settings to which the VAV's, the terminal devices of delivery, are indexed. The blower, heat exchanger, and controlled monitoring of all noted variables in assessing Total Mass Flow is therefore essential to the packaged system.

Despite their enumeration, it can be stated that the above groupings are the minimal features required to function as a whole. Thus, the consideration of the whole transcends the sum of its parts.

Linking Claims: Added Generic claim 307, added new claims 308, 309. Amended claim 296 (to include "straight fittings").

Daniel Stanimirovic, Inventor